Input from Y.Q. Wang, Professor in Terrestrial Remote Sensing
Department of Natural Resources Science, University of Rhode Island, Kingston, RI 02881-0804; (401) 874-4345; (401) 874-4561 (fax); yqwang@uri.edu. January 2006.

IMPACTS OF LAND-COVER CHANGE ON THE NATIONAL PARKS OF THE NORTHEAST TEMPERATE NETWORK, funded by NPS NETN

The Northeast Temperate Network (NETN) monitors the condition of resources in 10 national park units in seven northeastern states. The first step in developing a land-cover change monitoring program includes change detections for both within-park properties and changes within a 5-km (3-mile) buffer around each park. Among available remote sensing data sources, the project investigators selected the Landsat data because it provides a 30-year history from the early 1970s with nearly continuous coverage to the present time. Eight park units and 10 Appalachian National Scenic Trail segments were included in this project to create a retrospective assessment of land-cover change in the past 30 years, at approximately 13 years of time intervals. Analyses within the buffer zones provided information for resource managers to quantify land-cover changes adjacent to the parks and will help in setting priorities for monitoring and restoration.

The 8 NPS units include
1. Acadia NP,
2. Marsh-Billings-Rockefeller NHP;
3. Saint-Gaudens NHS;
4. Minute Man NHP;
5. Morristown NHP;
6. Saratoga NHP;
7. Roosevelt-Vanderbilt NHS; and
8. Weir Farm NHS.

The 10 Appalachian Trail segments, totaling about 362 kilometers (225 miles) from Maine to Pennsylvania, were selected based on observed changes and on the potential for future change as perceived by resource managers. Those include:
1) The Whitecap Mountain, Maine, which is in the midst of land that has been historically logged but conservation interest in the area is high;
2) The Saddleback Mountain, Maine, which is known for its arctic-alpine vegetation community on the smooth bedrock dome of the peak, and ranked as one of the most important places on the A.T. for species rarity;
3) The town of Hanover, New Hampshire - White Mountain National Forest, which is a major site that the effects of development on the A.T. will likely to affect wildlife;
4) The Chateauguay – No-town Area - as Vermont Fish and Wildlife and Green Mountain National Forest between Killington and Woodstock;
5) Tyringham Valley and Sheffield, Massachusetts;
6) Walkill Valley NPS ATPO, NJ DEP and Walkill National Wildlife Refuge;
7) Dunnfield Creek – Sunfish Pond NPS – Delaware Water Gap National Recreation Area;

8) Hawk Mountain Sanctuary, which is a globally significant migration flyway for thousands of raptors and millions of songbirds and is the focus of attention of the Kittatiny Coalition, a consortium of interested environmental and conservation public agencies and private organizations;
9) Rausch Gap/ St. Anthony's wilderness, Pennsylvania; and
10) Cumberland Valley, which is a rapidly developing residential and commercial area, due in part, to major transportation corridors that traverse the area.

Given the scope of the project and the Landsat sensor data, we considered the change analyses were effective for generalized land cover categories, in particular for the areas where there were no previous mapping efforts available. The NPS vegetation mapping projects had generated much more detailed vegetation maps for some of the parks. However the mapping results were limited within the NPS property boundaries and for one time period only. The Landsat imagery data provided extended data coverage for areas that surrounded NPS properties. The analyses revealed not only the land cover changes, but also the gateways and sensitive spots where the stresses exist from the neighborhood of the parks.

Results from NPS vegetation mapping projects provided valuable reference information for classification of Landsat data. In this project we used a *Stratified Classification – from Local-to-Global- Approach* to guide our classification process. This protocol is to mask out first the pixels that are most likely belong to mixed land cover categories, using NPS vegetation map as the base line information, so that the classification can be focused on the vegetation types and communities identified by the previous vegetation mapping projects. This protocol allowed us to:

1. value the NPS previous vegetation mapping efforts,
2. keep the classification system consistent
3. meet the goal of updating vegetation map
4. valid for change analysis and monitoring, and
5. it is a simple protocol for future mapping replications.

The lessons learned and our recommendations are as follows:

1. Although in general the resulted change analyses are informational, for future efforts, the Landsat data are recommended for large parks that have natural areas as the dominants of the landscape. For smaller National Historical Sites located within urban centers and suburban areas, the 30-m spatial resolution of Landsat imagery may not provide sufficient information needed by land managers.
2. When using Landsat imagery data for land cover mapping and change detection, the existing data from other governmental sources, such as USGS NLCD data and NWI data can be used to extract important information such as urban and wetland areas.
3. We recommend the higher spatial resolution satellite remote sensing data, such as IKONOS and QuickBird, be more frequently used. Both sensor systems provide multispectral and panchromatic digital data with high spatial resolution between 0.6 to 4 meters. Our other vegetation mapping projects in NPS Gateway National Recreation Area and the Fire Island National Seashore, NY, both using QuickBird images, proved that higher spatial resolution multispectral digital satellite data are

much more effective in terms of providing useful information on vegetation cover as well as conducting change analysis for inventory and monitoring purposes, particularly when teamed up with the results from NPS vegetation mapping projects.

4. For future data acquisition and mapping efforts, certain sizes of buffer zones around the NPS properties are recommended. The buffer areas will allow the mapping results to be more relevant to the land use patterns of the surrounding communities, as well as to identify where the major stressors are located in the neighborhood and how to plan and practice the land management accordingly.

For more information about this project, please visit *http://www.ltrs.uri.edu*.